

lying to the north-west. Such an arrangement would naturally lead to the formation of narrow and comparatively flat-bottomed valleys behind rocky gorges, the latter being cut through the vertical beds of hard grit and conglomerate along the Highland border. Evidence is adduced to show how this remarkable structure likewise contributed to the erosion of rock basins during the glacial period. The glacial phenomena of the region are reviewed, which indicate at least two periods of glaciation; one, when the ice-shed lay to the north of the area under consideration, when the ice-movement was independent of the existing valley-system, and when even the highest mountains were over-riden by the ice. This great development was followed by a period of local glaciation, when the glaciers were confined mainly to the existing valleys. Lastly, the soundings of the various lochs are viewed in relation to the geological history of the area, and with reference to the question of the origin of the various lakes. It is shown that some of the lochs are typical examples of rock basins, that in some instances the deepest soundings occur in front of the rocky barriers at or near their outlets. Reference is made to all the important faults traversing the region, which have led to the more rapid disintegration of the materials, but though they have in certain cases produced modifications of the floors of the lakes, they cannot account for the excavation of the rock basins. The soundings of Loch Lubnag reveal the striking fact that one of the deep basins in that lake lies on the upthrow side of the most powerful fault traversing the crystalline schists of that region. Messrs. Peach and Horne believe that the soundings of the various lakes in the basin of the Teith above Callander furnish strong evidence in support of Ramsay's theory of their excavation by ice-action.

The paper is illustrated by seven coloured maps, the first three showing on a small scale the orography and drainage areas, the surface geology and the rainfall of the district, the other four showing on a larger scale the bathymetry of the various lochs and the relief of the surrounding country. There are also numerous woodcuts, some of which are reproduced in this review.

IRON AND STEEL INSTITUTE.

THE annual meeting of the Iron and Steel Institute was held on Wednesday and Thursday, May 9 and 10, in the hall of the Institution of Civil Engineers, under the presidency of Sir William Roberts-Austen, K.C.B., F.R.S. The attendance of members was larger than at any previous gathering. The report of the council, which was read by the secretary, Mr. Bennett H. Brough, showed that the Institute is in a flourishing condition. The receipts last year were greater than in any previous year, 110 new members were added to the roll, the supply of original papers was well maintained, and a Royal Charter of Incorporation had been granted. After the usual formal business, the president presented the Bessemer gold medal for 1900 to Mr. Henri de Wendel, the eminent French metallurgist, in recognition of his great services to metallurgy in developing the iron-ore resources of French and German Lorraine. Mr. de Wendel having expressed his appreciation of the honour conferred upon him, Mr. Stead announced that he had decided to postpone the reading of his paper until the autumn meeting in Paris.

Mr. J. Riley then described the various attempts that have been made to use fluid metal in the open-hearth furnace. The results he obtained at Wishaw, in 1898, were encouraging, and experience over a considerable period show that great advantages are derived from the adoption of this method. The best future open-hearth practice, he considers, will include the use of fluid metal direct from the blast furnaces.

The next paper read was one of most conspicuous novelty, by Mr. B. Talbot, on the open-hearth continuous steel process. This process was introduced at the Pencoyd steelworks in Pennsylvania. The furnace used is a basic-lined tilting furnace of seventy-five tons capacity. Many thousands of tons of steel have been made by this method with very satisfactory results, all grades of steel having been produced. The cost and delay in charging cold material is avoided. There is a saving in fuel in charging molten pig iron. The demand for a large supply of good scrap is dispensed with. A regular supply of steel in any desired quantity and at frequent intervals is insured. There is an increased output, an increased yield, and a saving in repairs and in labour charges. At the same time it is possible to use

very large furnaces, with consequent reduction in cost of production, without the necessity for very large cranes and ladles. A long discussion followed the reading of the paper, the opinion being general that the process is an important advance in open-hearth steel practice.

Mr. A. Greiner gave an account of the results obtained at the Cockerill works, Belgium, with the first blowing-engine worked by blast-furnace gas ever employed in any ironworks. This 600 horse-power engine has been running since November 20 last with unpurified gas taken from the Seraing blast-furnaces.

Baron H. von Jüntner submitted a further instalment of his researches on the theory of solution of iron and steel. He discussed the application of the laws of chemical mechanics in the case of iron carbon alloys, and showed what an important bearing thermo-chemistry possesses for a knowledge of the constitution of the alloys of iron and their alterations of state.

The meeting then adjourned until May 10, when Mr. C. Dellwik dealt with the manufacture and application of water-gas, describing the production of the gas by means of a simple apparatus with a degree of economy surpassing that of other less valuable gas. Whilst in the old processes the gas leaving the generator during the blow contains principally carbon monoxide and nitrogen, in the author's process it consists chiefly of carbon dioxide and nitrogen.

The subject of utilising blast-furnace slag is a fruitful source of inquiry, and a recent important development was dealt with by Mr. C. von Schwarz. This is a successful method of manufacturing cement from blast-furnace slag, recently employed in Germany and Belgium. The cement thus made obtains a higher price in the market than ordinary Portland cement.

Mr. L. F. Gjers and Mr. J. H. Harrison described an apparatus for equalising the varying temperatures of hot blast. Hitherto the hot blast has been allowed to enter the furnace as it left the stove, and in order to obviate the interference with the steady working of the furnace, the authors have devised an apparatus consisting practically of another small stove with a central division wall. It is filled with chequer work; and the hot blast, entering at one side of varying temperature, is delivered out at the other side at an even mean temperature.

The form of ingot that would seem to be the most natural for the manufacture of a gun-tube or a propeller shaft is one with a circular section. Mr. F. J. R. Carulla, however, pointed out the drawbacks of this form, and showed that a polygonal ingot with concave sides answers the required conditions.

Mr. H. K. Scott contributed a paper on manganese ore deposits and mining in Brazil, giving a detailed account of the geological structure of the deposits, and of the economic development of the industry.

After the usual votes of thanks to the Institution of Civil Engineers, proposed by Sir John Alleyne, Bart., and to the president for his conduct in the chair, proposed by Mr. Carnegie, the proceedings terminated. Incidentally, Mr. Carnegie announced his intention of founding a scholarship in connection with the Iron and Steel Institute for the advancement of research in connection with iron and steel.

THE ROYAL SOCIETY CONVERSAZIONE.

THE general opinion of the scientific company at the Royal Society on Wednesday, May 9, on the occasion of the first of the two soirées held annually, was that novel and striking exhibits were not so numerous as in some exhibitions of previous years. The following were among the most noteworthy exhibits:—

Mr. Richard Kerr showed a clock controlled at a distance by wireless telegraphy of the Hertzian wave system. Mr. J. Wimshurst, F.R.S., exhibited an influence machine, constructed with twelve plates of vulcanite. Prof. Silvanus P. Thompson, F.R.S., showed some pretty electromagnetic experiments, one being the converse of De La Rive's experiment, using floating magnet instead of floating battery, and others showing new varieties of the De La Rive experiment (see p. 71). Prof. Minchin, F.R.S., showed that luminous flashes could be induced in a helium tube by Hertz waves.

An electric micrometer was shown by Mr. P. E. Shaw. The instrument was designed primarily to measure the small movements of a telephone diaphragm. A screw abuts on a system of three levers, set up on a strong wooden frame. By turning the

screw, the far end of the levers moves to and fro through distances which can be controlled and measured. This end of the levers carries a rod, and the diaphragm a small plate, both of iridio-platinum; if these two surfaces touch one another, a flow of a small amount of electricity occurs, producing a sound in a telephone held by the observer; at the same time he reads by a telescope a graduated circular scale fixed on the screw. Since the screw and levers can be moved at will by the observer, he can, by this contact method, find the position of the diaphragm, and follow its movements. Precautions against vibrations are taken by having indiarubber suspensions, and against temperature changes by covering the working parts with boxes wrapped in felt. Movements as small as $\frac{1}{100}$ th of a wavelength of sodium light have been measured by this apparatus.

Mr. Killingworth Hedges exhibited jointing boxes and aigrettes used in the rearrangement of the lightning conductors of St. Paul's Cathedral. The original system for the protection of the Cathedral from lightning was installed under the advice of the Royal Society in about 1756. This was replaced in 1872 by what was then considered the most improved method, when the unsoldered joints were found to be very defective; in some cases they were quite loose; also the earths, originally made by laying the cable in a drain which had become disused, were in some cases insulated from the ground. New earths have been substituted. The method adopted to protect the structure unites the old system and the new cables to a horizontal conductor run on the top of the parapet, entirely round the building; to this copper aigrettes as shown are teed at intervals.

Other electrical exhibits were models illustrating leakage from electric tramways, shown by Mr. A. P. Trotter, and improved forms of standard resistance coils made by the Cambridge Scientific Instrument Co., Ltd.

Dr. Isaac Roberts, F.R.S., exhibited his magnificent volume of photographs of stars, star-clusters and nebulae, recently reviewed in NATURE (vol. lxi. p. 533). The volume contains seventy-two photographs, which have been enlarged by mechanical processes from the original negatives, and they furnish evidence of the evolution of stellar systems from nebulous matter as seen in the convolutions of spiral nebulae. They also furnish a foundation for the inference that the system of the *Milky Way* is not unlimited in extent, and that the numerous aggregations of stars, seen in lines and curves in the stellar regions, indicate their development from spiral nebulae.

Mr. Thomas Thorp exhibited some of his grating films and their application to diffraction colour photography, on Prof. Wood's principle. Dr. Downing, F.R.S., exhibited maps illustrating the track of the total eclipse of the sun of May 28.

Mr. W. A. Shenstone, F.R.S., and Mr. H. G. Lacell showed a quantity of non-splintering silica, suitable for use in the oxy-gas flame. The method of converting this into tubes and other forms of apparatus, as recently described in NATURE (May 3), was demonstrated practically, together with experiments to illustrate the behaviour of vitreous silica under sudden and great changes of temperature. The following apparatus, constructed of silica, was also exhibited. A long tube for use with a platinum thermometer; a mercury thermometer; bulbs and stems for thermometers; a Giessler tube; a small distilling tube; and rods and tubes of various sizes for various purposes.

Some examples of leadless glazed ware were shown by Dr. T. E. Thorpe, F.R.S.

Mr. H. B. Hartley and Mr. H. L. Bowman gave a demonstration of the properties of crystals yielding doubly-refracting liquids on fusion. Certain crystalline organic compounds, viz. *p*-Azoxyanisol, *p*-Azoxyphenetol, and Cholesteryl benzoate, have been found by Prof. Lehmann, of Carlsruhe, to give on melting (at temperatures of 116°, 134° and 145° respectively) liquids possessing the properties of double-refraction and dichroism, even under conditions in which a state of strain is impossible. When these anisotropic liquids are further heated, they change at definite temperatures of transition (134°, 165° and 178° respectively) into ordinary isotropic liquids. The intermediate bodies have been called "liquid crystals," for, although the evidence of their elasticity, viscosity, and dielectric capacity shows them to be undoubtedly liquids, yet nevertheless they possess, like crystals, both double refraction and dichroism.

Specimens from the reefs of Funafuti were exhibited by Prof. J. W. Judd, C.B., F.R.S., on behalf of the Coral-Reef Committee of the Royal Society. The exhibits included:—(1) Specimens illustrating the rate of growth of corals and

calcareous algae from the reefs of Funafuti. Experiments made by Mr. A. E. Finckh, of Sydney, who in 1898 carried the boring made by Prof. T. E. David in the previous year from the depth of 698 ft. to 1114 ft., have thrown much new light upon this important question. Specimens illustrating these experiments are exhibited. (2) New and interesting forms of Foraminifera, which have been described by Mr. F. Chapman. These include:—(a) *Cycloclypens*, a genus previously regarded as being very rare, but now shown to exist abundantly at Funafuti. The two species formerly described are now shown to be dimorphic forms of the same organism. (b) A curious form of *Polytremna*, which occurs encrusting various objects in alternate layers with the marine alga *Lithothamnion*, thus forming loose nodules. (c) The newly-described *Haddonina*, first obtained from Torres Straits, &c.

Prof. H. G. Seeley, F.R.S., showed drawings of restorations of Dimorphodon. The drawings, of the natural size, are based upon fossil remains from the Lias, in the British Museum. They represent the skeleton as in the quadruped and biped positions; and show the contours of the body at rest, walking, and preparing for flight, to illustrate proportions of the skeleton. Dr. C. I. Forsyth-Major exhibited remains of extinct gigantic and lesser lemurs from Madagascar, and living forms for comparison. Some beautiful examples of chalk fossils were exhibited by Dr. Arthur W. Rowe.

Dr. Manson exhibited longitudinal sections of filarated mosquitoes (*Culex ciliaris*), showing that *Filaria nocturna*, like the malaria parasite, leaves its mosquito host *viâ* the proboscis.

A collection of living marine worms (Annelids) from the neighbourhood of Plymouth, designed to illustrate, as far as possible, the prominent features in the habits of life of the different types of this class of animals, and such modifications of form as are related thereto, formed the exhibit of the Marine Biological Association.

Prof. E. Ray Lankester, F.R.S., on behalf of the Archaeological Survey of the Egypt Exploration Fund, showed reproductions of paintings and sculptures in tombs of Ancient Egypt, representing domestic and wild animals and birds. The tombs of Ancient Egypt contain abundant representations of animal life. In spite of the artists' ignorance of perspective and occasional faulty colouring, the outlines are rendered with remarkable fidelity to nature, often enabling the species to be identified. Among domestic animals, the dogs are perhaps the most interesting, as showing that extreme development of various breeds had already taken place. The monuments from which the drawings exhibited were copied are of two periods:—(1) Tombs at Beni Hasan, of the XIIth Dynasty (circa 2000 B.C.); (2) the Tomb of Ptah-hetep at Saqqarah, of the Vth Dynasty (circa 3000-2500 B.C.).

Prof. A. C. Haddon, F.R.S., showed specimens illustrating the decorative art of the Sea Dayaks of Sarawak. The carved and painted designs of the Dayak men are entirely different from the woven and embroidered patterns made by the women. The former are chiefly plant derivatives, while the latter are mainly greatly modified animal forms. The significance of the distinction and the real meaning of the patterns themselves are not yet elucidated. The method by which the women make the patterns in their woven fabrics was also illustrated. The warp is stretched on a frame, and numerous strands are tied tightly with strips of leaves; the whole is removed and then submerged in a dye. The lashing is then undone, and the tied-up portions are found to be undyed. The whole process is repeated if a three-colour pattern is required.

Ethnographical objects from Malay Peninsula (Malay and Sakai) were shown by Mr. W. W. Skeat. The phonographic records of songs of the Pangan tribe, a wild aboriginal tribe of Negrito stock, received much attention.

A collection of anthropometric instruments was shown by Dr. J. G. Garson.

The Royal Geographical Society exhibited a section cut from the tree on Lake Bangweulu, Central Africa, under which Livingstone's heart was buried, and containing the inscription carved by his native followers.

In the course of the evening, short discourses and demonstrations were given by Sir Andrew Noble, K.C.B., F.R.S., on modern explosives; Dr. Arthur W. Rowe, on the photomicrography of chalk fossils by reflected light; and Mr. F. Enock, on photographs from living insects, showing the metamorphoses of one of the Odonata.